

Dr. Kaufman Is Awarded Grant To Research Binocular Interaction

Dr. Lloyd Kaufman, associate professor of psychology, recently received a grant from the U. S. Army Medical Research and Development Command to investigate binocular interaction. His research aims and tentative findings are presented here.

The way in which the two eyes work together in seeing in depth is a problem with a long history. Scholars have been writing on this subject since the Renaissance. Johannes Kepler was one of the first to realize that people should have persistent double vision because their two eyes view the world from different positions. Yet most people are unaware of their double images.

Two Answers Offered

Two answers have traditionally been offered to the question of why people are unaware of their double images. One of them is more widely accepted than the other. It states that the double images fuse or combine at different depths, depending upon their amount of doubleness or disparity, thereby eliminating the double vision. This is the fusion theory and it explains both singleness of vision and depth perception. It has, in its various forms, been in existence since the early 17th century. An alternative view, one which stems from Porta in the 15th century and duTour, in the 17th, is that we see through one eye at a time. While the image in one eye is suppressed, the other eye's image enters awareness. This explains the singleness of vision, but no mechanism is provided for the occurrence of depth perception which is known to depend upon the doubleness or binocular disparity. In my own work

I am trying to extend our knowledge of how the eyes work together and, incidentally, test and extend the fusion and suppression theories.

In the course of my studies of binocular interaction, I have shown that fusion or combining of the two images is not necessary for depth perception. Binocular depth perception, or stereopsis, is possible when the patterns presented to the two eyes have remarkable differences. Contours may run in completely opposite directions but, if they are properly arranged, depth perception will occur. It turns out that the two eyes work on the distributions of brightness in their respective images before depth perception can occur. This process is independent of fusion. Moreover, one eye's image may be completely suppressed and depth may still occur. Simple fusion theories are therefore not applicable to the phenomena of stereopsis.

A more adequate suppression theory is now being developed. Suppression operates in a piecemeal fashion. Different parts of the two eyes' views may be suppressed at the same time. We are attempting to map these patterns of suppression since they show lawful variations depending upon the nature of the visual stimuli.

Binocular interaction is a broader problem than depth perception. It may well be a means for a deeper understanding of the ways in which different parts of the nervous system work together in general. To this end we have been seeking objective physiological indicators of

continuing our work on human brain waves. We study the ways in which the brain waves fluctuate in the course of changes in binocular stimulation.

This work led to the discovery that it is possible to detect the modulation of brain waves as fast as 1000 cycles per second by a slowly flashing light stimulus. This work was done with the collaboration of Robert Price. We believe that this high-frequency activity represents the firing of neurons in the brain and that its modulation by light reflects the fact that more neurons or nerve cells are firing when the light is flashed on and off. We are now investigating the effects of stimulation on both the classical and the new high-frequency brain-waves.